Appendix II

Pathogens in Tomales Bay Watershed Total Maximum Daily Load (TMDL)

Basin Plan Amendment

Tomales Bay Watershed Pathogens TMDL

The overall goal of the Tomales Bay Watershed Pathogens Total Maximum Daily Load (TMDL) is to ensure protection of water contact recreational uses and Bay shellfish harvesting, thereby minimizing human exposure to disease-causing pathogens. The following sections establish a density-based pathogens TMDL for Tomales Bay and its tributaries, and actions and monitoring necessary to implement the TMDL. The TMDL defines allowable density-based water quality bacteria concentrations and prohibits the discharge of human waste. The associated implementation plan specifies the actions necessary to protect and restore beneficial uses. This TMDL strives to achieve a balance that allows human activities including agriculture, recreation, commercial fishing and mariculture, and residential use to coexist and also restores and protects water quality. As outlined in the adaptive implementation section, the effectiveness of implementation actions, monitoring to track progress toward targets, and the scientific understanding pertaining to pathogens will be periodically reviewed and the TMDL may be adapted as warranted.

In addition to pathogens, animal and human waste contain nutrients that pose a threat to aquatic ecosystem beneficial uses. Tomales Bay, Walker Creek, and Lagunitas Creek are listed as impaired by excess nutrients. Human and animal wastes may also contain other harmful constituents such as steroids and pharmaceuticals. In addition to protecting pathogen-impaired beneficial uses such as shellfish harvesting, water contact recreation, and non-contact water recreation, by eliminating the discharge of human waste and controlling the discharge of animal waste, this TMDL will also protect aquatic ecosystem beneficial uses such as marine habitat, estuarine habitat, cold and warm freshwater habitat, and wildlife habitat from other harmful constituents found in human and animal waste.

Problem Statement

Monitoring results for Tomales Bay and its main tributaries (Lagunitas, Walker, and Olema creeks) indicate that these waters exceed bacteria water quality objectives for

shellfish harvesting and recreational waters (Table 3-1) and, as such, are impaired by pathogens. The presence of pathogens is inferred from high concentrations of fecal coliform bacteria (a commonly used indicator of human pathogenic organisms). Pathogen pollution is adversely affecting existing beneficial uses, which include shellfish harvesting (i.e., sport and commercial oyster, clam, and mussel harvesting), water contact recreation (i.e., swimming, fishing) and non-contact water recreation (i.e., boating, kayaking).

This TMDL addresses the following pathogen-impaired water bodies in the Tomales Bay Watershed:

- Tomales Bay
- Lagunitas Creek
- Walker Creek
- Olema Creek

Sources

If not properly managed, the following Tomales Bay Watershed source categories have the potential to discharge pathogens to surface waters: on-site sewage disposal systems (OSDSs), small wastewater treatment facilities and sewage holding ponds, vessel discharges, grazing lands, dairies, equestrian facilities, and municipal runoff. Pathogens sources are identified based on elevated coliform bacteria levels downstream of identified land uses or facilities and from documentation of inadequately treated human waste discharges.

- The Walker Creek watershed is dominated by grazing lands. Coliform bacteria levels and coliform loads from the Walker Creek watershed are extremely high during storm periods and a significant coliform source to Tomales Bay.
- High coliform levels detected in storm drains indicate that municipal runoff is a pathogens source.
- High coliform levels and loads downstream of residential homes and equestrian facilities suggest that failing septic systems, municipal runoff, and equestrian facilities are coliform sources.
- The Water Board regulates ten small wastewater treatment facilities and sewage holding ponds and prohibits direct discharges from these facilities into Tomales Bay or its tributaries. Four facilities have holding ponds and are permitted to discharge treated effluent to irrigation fields in the dry season. The other six wastewater treatment facilities utilize leach fields for dispersing treated effluent. Accidental malfunctions, including the breaching of ponds, a break in a sewage line, or land application when soil is saturated or it is raining, could result in discharge of untreated or partially treated effluent. Therefore, these facilities are considered potential sources.

In addition to the above sources, warm-blooded mammals and birds that reside in the watershed and Bay produce coliform bacteria. During non-storm periods Tomales Bay coliform levels are typically below the water quality objectives for shellfish harvesting waters, indicating that in-Bay wildlife such as seals and birds are not significant sources.

Approximately 30% of the lands draining to Tomales Bay are open space forested lands. Water quality monitoring of a watershed on the western shoreline of Tomales Bay with minimal human influences suggests that waters draining open space areas are below tributary bacteria water quality objectives and therefore terrestrial wildlife are not a significant source.

Numeric Targets

Table 4-20 contains the numeric water quality targets for the Tomales Bay Watershed Pathogens TMDL. The coliform bacteria targets are based on fecal coliform bacteria concentrations aimed at protecting shellfish harvesting and contact and non-contact water recreation beneficial uses. These density-based numeric targets define bacterial densities associated with minimal risk to humans and are the same as the water quality objectives contained in Table 3-1. The Tomales Bay targets are intended to protect the most sensitive beneficial use, shellfish harvesting. The tributary targets are intended to protect recreational uses. An additional numeric target for Tomales Bay is expressed as the number of days commercial shellfish growing areas are subjected to harvest closures due to elevated water column bacteria densities. Consistent with the definition of "threatened conditions" in the California Shellfish Protection Act, Tomales Bay shellfish growing areas shall not be closed for harvest for more than 30 days per calendar year. The California Department of Health requires shellfish growing areas to close for harvesting when 24-hour and 10-day rainfall totals exceed established thresholds. Rainfall thresholds are established based on the relationship between rainfall and observed fecal coliform levels in Bay waters and shellfish.

In addition, no human waste (raw sewage or inadequately treated waste) shall be discharged to Tomales Bay or its tributaries. The no human waste discharge target is consistent with Discharge Prohibitions 5 and 15, contained in Table 4-1. This target is necessary because human waste is a significant source of pathogenic organisms, including viruses; and attainment of fecal coliform targets alone may not sufficiently protect human health. The coliform bacteria targets, in combination with the human waste discharge prohibitions and the shellfish harvesting closure targets, are the basis for the TMDL and load allocations, and fully protect beneficial uses.

Table 4-20
Water Quality Targets[a] for Tomales Bay and Its Tributaries

Zero discharge of human waste
Shellfish harvest closures < 30 days/year
Coliform Bacteria Levels *(Expressed as Most Probable Number [MPN] of fecal coliforms per 100 mL of water)* ***Tomales Bay*** ***Median < 14 [b] and 90th percentile < 43 [c]***

Tomales Bay Tributaries ***Log mean <200 [b] and 90th percentile < 400 [c]***
[a.] These targets are applicable year-round ***[b.] Based on a minimum of five consecutive samples equally spaced over a 30-day period*** ***[c.] No more than 10% of total samples during any 30-day period may exceed this number.***

Total Maximum Daily Load

Table 4-21 lists the Tomales Bay Watershed Pathogens TMDL. The TMDL consists of the density-based coliform bacteria TMDL targets. The TMDL ensures protection of water contact recreational uses and Bay shellfish harvesting, thereby minimizing human exposure to disease causing pathogens.

Table 4-21
Total Maximum Daily Load of Pathogens Indicators for Tomales Bay and its Tributaries

Waterbody	*Indicator Parameter*	*TMDL* ***(Most Probable Number (MPN) of fecal coliforms per 100 mL of water)***
Tomales Bay	***Fecal coliform***	***Median < 14 [a]*** ***90th Percentile < 43 [b]***
Major Tributaries: ***Walker Creek*** ***Lagunitas Creek*** ***Olema Creek***	***Fecal coliform***	***Log mean <200 [a]*** ***90th percentile < 400 [b]***
[a.] Based on a minimum of five consecutive samples equally spaced over a 30-day period. ***[b.] No more than 10% of total samples during any 30-day period may exceed this number.***		

Load Allocations

TMDL targets are an interpretation of water quality standards, whereas TMDL allocations specify the amount (or concentration) of a pollutant that can be discharged to a waterbody such that standards are attained in both the receiving waterbody and all downstream waters. Table 4-22a presents density-based load allocations for Tomales Bay watershed pathogens source categories that implement tributary targets, and Table 4-22b presents allocations to major tributaries, where they discharge to Tomales Bay, and implement the Bay targets. Load allocations to the tributaries reflect the highest fecal coliform concentrations that can be discharged while still attaining and maintaining the Bay shellfish harvesting water quality objectives. All entities in a watershed are responsible for meeting their source category allocation (Table 4-22a) and the applicable geographic-based allocations (Table 4-22b).

Discharging entities will not be held responsible for uncontrollable coliform discharges originating from wildlife. If wildlife contributions are determined to be the cause of exceedances, the TMDL targets and allocation scheme will be revisited as part of the adaptive implementation program. The discharge of human waste is prohibited. All sources of human waste have an allocation of zero. Nonpoint source runoff containing coliform bacteria of animal and wildlife

origin, at levels that do not result in exceedances of water objectives, does not constitute wastewater with particular characteristics of concern to beneficial uses. Therefore, animal and wildlife-associated discharges, in compliance with the conditions of this TMDL, do not constitute a violation of applicable discharge prohibitions.

Table 4-22a

Density-Based Pollutant Wasteload and Load Allocations[a] for Dischargers of Pathogens in Tomales Bay Watershed

Categorical Pollutant Source	Wasteload and Load Allocations Fecal Coliform (MPN/100 mL)		
	For Direct Discharges to the Bay		For Discharges to Major Tomales Bay Tributaries
	Median[b]	90th Percentile[c]	Log Mean[b]
Onsite Sewage Disposal Systems	**0**	**0**	**0**
Small Wastewater Treatment Facilities	**0**	**0**	**0**
Vessel Discharges	**0**	**0**	**N/A**
Grazing Lands	**<14**	**<43**	**< 200**
Dairies	**<14**	**<43**	**< 200**
Equestrian Facilities	**<14**	**<43**	**< 200**
Municipal Runoff	**<14**	**<43**	**< 200**
Open space lands (terrestrial wildlife) [d]	**<14**	**<43**	**< 200**
In-Bay Background (marine wildlife) [d]	**<14**	**<43**	**N/A**

a. These allocations are applicable year-round. Wasteload allocations apply to any sources (existing or future) subject to regulation by a NPDES permit.
b. Based on a minimum of five consecutive samples equally spaced over a 30-day period.
c. No more than 10% of total samples during any 30-day period may exceed this number.
d. Open space lands and the Bay contain wildlife and are therefore recognized as potential source areas. These areas are not believed to be a significant source of pathogens and their contribution is considered natural background; therefore, no management measures are required.

TABLE 4-22B

DENSITY-BASED POLLUTANT LOAD ALLOCATIONS FOR TOMALES BAY TRIBUTARIES

Tributary	Allocation Fecal Coliform (MPN/100 mL) Log Mean

Walker Creek at Highway 1 Bridge	***95[a]***
Lagunitas Creek at Green Bridge	***95[a]***

a. Based on a minimum of five consecutive samples equally spaced over a 30-day period.

Implementation Plan

The Tomales Bay Watershed Pathogens TMDL Implementation Plan builds upon previous and ongoing successful efforts to reduce pathogen loads in Tomales Bay and its tributaries. The plan requires actions consistent with the California Water Code (CWC 13000 et seq.), the state's Nonpoint Source Pollution Control Program Plan (CWC Section 13369) the Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program[1] and human waste discharge prohibitions (Prohibitions 5 and 15, Table 4-1).

This plan specifies required implementation measures (Table 4-23) for each of the source categories (Table 4-22). These implementation measures include evaluation of operating practices, development of comprehensive site-specific pathogens control measures and an implementation schedule for such management measures, and submittal of progress reports documenting actions undertaken. Progress reports may be submitted directly to the Water Board or, if designated, through third parties. These progress reports will serve as documentation that source reduction measures are being implemented. While third parties may provide valuable assistance to TMDL implementation, the discharger is the entity responsible for complying with the specified regulations and regulatory controls. Responsible parties within each source category are required to implement the measures as specified in Table 4-23. The numeric targets and load allocations are not directly enforceable. For purpose of demonstrating attainment of applicable allocations, responsible parties will only be responsible for compliance with specified implementation measures and applicable waste discharge requirements or waiver conditions.

The state's Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program requires that current and proposed nonpoint source discharges are regulated under waste discharge requirements (WDRs), waiver of waste discharge requirements, Basin Plan prohibitions, or some combination of these tools. Table 4-24 describes the method that will be used to regulate dischargers in each source category. The Water Board has established conditions for waiving WDRs for dairies. The Water Board intends to work with stakeholders to develop similar waiver conditions for grazing lands and equestrian facilities by 2009.

[1] State Water Resources Control Board. 2004. *Policy for Implementation and Enforcement of the Nonpoint Source Pollution Prevention Control Program*.